	L #	Hits	Search Text	DBs	Time Stamp
1	L1	1948	trench adj oxide	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 14:51
2	L2	13670	plasma and teos	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 14:51
3	L3	348	1 and 2	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 14:51
4	L5	13	remove adj collar adj oxide	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 14:52

	L #	Hits	Search Text	DBs	Time Stamp
5	L4	55	plasma adj etch and 3	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 14:59
6	L6	6	(("6723658") or ("6566228") or ("6638815")).PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 15:04
7	L7	0	6 and pecvd	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 15:05
8	L8	2	6 and plasma	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 15:05

	L #	Hits	Search Text	DBs	Time Stamp
9	L9	1653	((438/424) or (438/425) or (438/426)).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 17:12
10	L10	431	9 and 2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 17:12
11	L11	284	10 and (trench near2 oxide)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 17:13

	L #	Hits	Search Text	DBs	Time Stamp
12	L12	266	11 and ((@ad<"20030130") or (@rlad<"20030130"))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 17:18
13	L13	80	12 and (pecvd)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 17:18
14	L14	80	13 and (pecvd or "plasma enhanced chemical vapor deposition")	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	2005/04/09 17:19

US-PAT-NO: **6566228**

DOCUMENT-IDENTIFIER: US 6566228 B1
See image for Certificate of Correction

TITLE: Trench isolation processes using polysilicon-assisted fill

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US Patent No. - PN (1):
6566228

Detailed Description Text - DETX (3):
Referring to FIG. 2, array and support mask openings 15a and 15b are etched into the array and support areas, 1a, 1b, usually by lithography and **plasma** reactive ion etch (RIE). These mask opening define the locations and dimensions of the isolation trenches that will be etched into the substrate below the pad nitride layer in later steps. Commercially available RIE systems for use in the invention include those sold under the "Etch Centura" tradename series by Applied Materials, among others. Such systems utilize a glow discharge and electrodes to combine the benefits of sputtering with those of enhanced **plasma** etching and to produce highly anisotropic etches. The etches will preferable penetrate the pad oxide 11 all the way down to the substrate 10.

Detailed Description Text - DETX (6):
Referring to FIG. 5, the photoresist is removed, thereby resulting in a structure wherein only deep array trenches are provided. Organic polymers may be etched by almost any **plasma** process containing high concentrations of oxygen gas. Oxygen **plasmas** are especially selective with respect to polysilicon, silicon oxide, and aluminum structures and will therefore leave such structures unharmed. The addition of fluorine-containing gases, such as

CF.sub.4 or
CHF.sub.3, CH.sub.2 F.sub.2, or CH.sub.3 F, will significantly increase the etch rate, though also cause etching of any silicon nitride structures present.

Detailed Description Text - DETX (19):

The structure of polysilicon deposited using LPCVD techniques will generally depend on reaction temperature. Films deposited at temperatures below about 580 C. will generally be amorphous, while those above that temperature will be polycrystalline Referring to FIG. 10, the conductive material fill 21' is etched down until all conductive material fill 21' material is removed from the support mask openings and the etch penetrates into the substrate 10 to a desired depth, thereby providing array trench isolations 15a'. The result is that the array and support trenches 15a', 15b' are now at identical depth, with a conductive element 21 installed in the bottom of the deep trenches. This is desirable because identical depths will make later planarization steps easier by yielding a favorable topography from later deposition steps. To ensure equal depths is achieved, the conductive material fill 21' and the substrate 10 will be chosen to be of materials that etch at substantially the same rate under identical etching conditions. The most straightforward means of achieving this is to use the same material for both, but it is sufficient that one be silicon and the other polysilicon, because these two forms of silicon etch at nearly identical rates. The etch may be a reactive ion etch, for example, or a suitable **plasma** etch, such as in a methyl trifluoride (CHF.sub.3) environment. The etch will preferably start off anisotropically and finish isotropically so as to avoid damaging any silicon substrate that might be exposed just above the oxide liner 20a Referring to FIG. 11, the first oxide hardmask 13 is removed, causing the exposed portions of the liner

oxide 20a to be stripped away. Removal of the oxide may be accomplished with a wet hydrofluoric acid (HF) bath or dry **plasma** HF etch.

Detailed Description Text - DETX (23):

Generally, the reaction pressure will be rather low, generally below ten mTorr, and will usually be conducted in a magnetron sputtering environment. Under these conditions, the film being deposited begins to cover all the surfaces on the wafer conformally, including the sidewalls and bottoms of contact holes and trenches. Under normal CVD processes, this would cause an overhang at the rims of the trenches and holes that would eventually close off at the top, thereby leaving a cavity within. However, in HDP deposition the excitation of the inert gases and reactants into a high-energy **plasma** causes the deposited material to be continuously sputtered away even as it is being deposited. The result is that the deposited material behaves like a fluid and settles into the trenches and holes in a planarized, rather than conformal, manner and thereby avoiding the formation of any cavities.

Detailed Description Text - DETX (24):

HDP-CVD reactors will generally utilize a glow discharge to produce ions powerful enough to cause sputtering in the material being deposited. Glow discharges are a self-sustaining **plasma** produced by either or both of a dc-diode type system or an rf-diode system. An inert gas, such as Argon is introduced between a pair of electrodes with a strong enough electric field to ionize the reactant and inert gases to a **plasma**. Rf-diode systems are preferred because they can operate at significantly lower pressures and deliver higher deposition rates than dc-diode systems. A preferred rf-diode system will be equipped with a magnetron source so as to help confine electrons near the wafer surface.

Detailed Description Text - DETX (43):
Referring to FIG. 32, an oxide fill 22 is deposited. This may be accomplished with a high-density **plasma** CVD (HDP-CVD) process.